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Article

TPGS-Stabilized Curcumin Nanoparticles Exhibit Superior Effect on Carrageenan-Induced Inflammation in Wistar Rat

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Abstract: Curcumin, a hydrophobic polyphenol compound derived from the rhizome of the Curcuma genus, has a wide spectrum of biological and pharmacological applications. Previously, curcumin nanoparticles with different stabilizers had been produced successfully in order to enhance solubility and per oral absorption. In the present study, we tested the anti-inflammatory effect of D-α-Tocopheryl polyethylene glycol 1000 succinate (TPGS)-stabilized curcumin nanoparticles in vivo. Lambda-carrageenan (λ-carrageenan) was used to induce inflammation in rats; it was given by an intraplantar route and intrapelurally through surgery in the pleurisy test. In the λ-carrageenan-induced edema model, TPGS-stabilized curcumin nanoparticles were given orally one hour before induction and at 0.5, 4.5, and 8.5 h after induction with two different doses (1.8 and 0.9 mg/kg body weight (BW)). Sodium diclofenac with a dose of 4.5 mg/kg BW was used as a standard drug. A physical mixture of curcumin-TPGS was also used as a comparison with a higher dose of 60 mg/kg BW. The anti-inflammatory effect was assessed on the edema in the carrageenan-induced paw edema model and by the volume of exudate as well as the number of leukocytes reduced in the pleurisy test. TPGS-stabilized curcumin nanoparticles with lower doses showed better anti-inflammatory effects, indicating the greater absorption capability through the gastrointestinal tract.

Keywords: curcumin; nanoparticle; inflammation; λ-carrageenan; nanoparticle permeability; Biopharmaceutical Class System (BCS) 4

1. Introduction

Curcumin, commonly called diferuloyl methane, is a hydrophobic natural polyphenolic phytoconstituent derived from the rhizomes of *Curcuma longa Linn* (Zingiberaceae). Curcumin is a major compound of curcuminoid. It has better radical scavenging and antioxidant abilities compared to demethoxycurcumin and bis-demethoxycurcumin. Curcumin is an amphipathic molecule with polar central and flanking regions that are separated by a lipophilic methine segment. It has a pKa1, pKa2, and pKa3 value of 7.8, 8.5, and 9.0, respectively for three acidic protons [1]. Curcumin has a high partition coefficient (log P) in the range of 2.3 to 2.6 [2–4]. Despite the polarity of the functional groups and the central dicarbonyl moiety, curcumin, overall, is hydrophobic. This is evidenced by its

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